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The Editor's Page

REGISTRATION for the special program in textile testing and research, conducted under the direction of Edward R. Schwarz, Professor of Textile Engineering, Massachusetts Institute of Technology, has reached the permissible maximum. The course starts on Saturday, April 2 and continues on successive Saturdays through June 4, omitting April 30. The principal subjects are microscopical analysis and physical testing, with instruction by means of conferences, lectures and demonstrations, and laboratory work.

* * *

THE president-designate of The Textile Institute, Manchester, Eng., is Frank Nasmith, Honorary Secretary and a vice-president of the Institute, and prominently identified with it in other capacities for many years. Mr. Nasmith is well known in this country for his previous identification with textile journalism, and also as the British representative for many years of the Universal Winding Co. Mr. Nasmith and J. R. S. Goodall, chairman of the Diplomas Committee of The Textile Institute, are reported to be planning a visit to this country in May in the interests of the Institute.

* * *

THE American Standards Association reports that American participation with the work of the technical committee on textiles of the International Standards Association (ISA), looking toward the unification of national textile standards, will be through the textile committee (Committee D–13) of the American Society for Testing Materials of which committee Prof. Herbert J. Ball is chairman. This project of the International Standards Association is known as ISA 38, Textiles. The American Standards Association is co-operating through Committee D–13 of the A. S. T. M.

* * *

A National Research Laboratories Institute is in process of organization by the Division of Engineering and Industrial Research of the National Research Council, of which Maurice Holland is director. Briefly stated its objectives "will be less in specific research projects, than in better methods in all research; in increasing the value, effectiveness and the success of research everywhere." Excepting for the fact that the main purpose of U. S. Institute for Textile Research has been the promotion of textile research on a co-operative basis, and the fact that the objectives of the new organization cover all types of industrial research, there is a striking similarity between the two organizations. In its efforts to acts as a clearing house for world textile research information U. S. Institute has made marked progress. It has aided manufacturers frequently in suggesting methods for the organization, equipment and conduct of laboratories. Unquestionably the latter type of service can be best performed by an organization in intimate touch with all types of industrial research. Associated with Mr. Holland as officers of the Division of Engineering and Industrial Research are Vannevar Bush, vice-president of Massachusetts Institute of Technology, who is chairman, and Howard A. Poilon, president, Research Corp., who is vice-chairman.

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Stream Pollution by Mill Wastes

New Legislative Control Proposed—Textile Foundation Research Solving Problem for Textile Mills

DURING the last few years numerous stream pollution bills have been introduced into Congress. Until recently however, there was not a sufficient backing of public sentiment to insure the enactment of any legislation. During the last session bills of this nature passed both houses of Congress. The theory of the bill passed by the House was somewhat different than that of the Senate measure and although it would seem to be somewhat of a problem to reconcile the bills in a conference committee, there is good reason to expect that it will be done and that some compromise bill will be enacted during the present session. The two versions may be briefly characterized as follows:

The Vinson Bill (H.R. 2711): Provides for vesting in the Federal Government certain investigative, advisory and coördinating functions but leaves to individual states the actual function of preventing or controlling water pollution.

Companion Senate Measure, The Barkley Bill (S. 702): This was originally identical with H.R. 2711 but was amended by the proponents of the Lonergan Bill (S. 13) who wished to give the Federal Government full power to establish stream-quality standards and to control the disposition of all wastes. This amendment provides that the Federal Government shall enforce standards by injunction instead of leaving the policing to the several States. The Senate version therefore puts almost complete authority in the Federal Division of Water Pollution Control to be established by the measure.

As far as the individual manufacturer is concerned he may in some cases have the option of working out his problem individually or in conjunction with a local municipality or other political subdivision which likewise will be faced with the necessity of new treatment of sewages. It must be realized, however, that the probabilities are that a Governmental agency will be empowered to take action to purify the waters of streams and rivers and such agency will be in a position definitely to prohibit the discharge of industrial wastes regardless of whether or not the industries immediately concerned can obtain co-operation and assistance from the cities in which they are located.

Textile Foundation Research on Problem

Foreseeing the present development and recognizing the desirability of providing information for the textile industry regarding the nature and magnitude of its stream pollution problem as well as means of applying suitable and economical treatment to textile processing wastes, the Textile

Foundation instituted a program of research in this field more than five years ago. This program, which has been carried on at Chapel Hill and Greensboro, N. C., in co-operation with the University of North Carolina, has been progressively expanded and at the present time is engaging the fulltime efforts of seven investigators, working under the direct supervision of Dr. H. G. Baity and Dr. Frank K. Cameron.

In the Department of Chemistry of the University of North Carolina fundamental studies relating to the physical and chemical nature, behavior and control of these waste materials are in process. By the use of pilot plants located at a large textile mill in Greensboro, N. C., the Department of Sanitary Engineering of the University is carrying forward its investigations of the treatment of individual textile waste liquors as well as their treatment in combination with domestic sewage. To date much helpful information has been derived, some of which has already been published in various scientific and engineering journals.

General Statement of Problem

The significant textile wastes, as far as stream pollution is concerned are those liquid wastes or sewages which contain appreciable amounts of suspended and soluble material. It may appear a simple matter to rid the mill sewage of such substances as dyestuffs, waxes, lime, soap, dirt and fibre, but actually it is a very difficult problem and one that calls for an intimate knowledge of the character and behavior of these materials when carried in water. If every mill is to discover what is to be done, the cost to the industry will be enormous and the amount of money which would be wasted because of lack of basic information would be heartbreaking. Fortunately it is possible by continued and carefully guided research to gather the much-needed basic information. It is almost certain that as this knowledge is acquired the difficulty of the problem will decrease to the great financial benefit of the industry.

The principal objection to disposal of untreated textile wastes into streams is due to the fact that the materials carried in the waste water undergo combustion or decomposition in the stream and by these processes use up the oxygen in the stream water. This suffocates the fish and other stream organisms, and causes the water to become stale or putrid.

The main problem then of all waste disposal is to get around the fact that the waste absorbs oxygen. The obvious answer would be: oxidize it before it gets into the stream. Unfortunately this is next to impossible for most types of materials. The liquors containing hydrogen sulfide can be oxidized if they are collected before they are discharged into the stream, but the oxidation of the gums, starches, and waxes frequently mixed up with lime soaps, is essentially impossible by any one process. It would be much better and is more feasible to remove it. Here again the answer appears easy until it is tried. Why should not these waste liquors be filtered? Any one who has tried filtering a suspension of lime soaps such as hard water forms, will readily agree that filtration is doomed to failure because the first layer of material deposited is enough to clog the filter. And if it is necessary to break the surface every few days the expense and inconvenience become too great.

(*Continued on page 194.*)

Fundamental Properties of Textile Wastes. I. Foreword

By DR. FRANK K. CAMERON *

A Textile Foundation Publication

IDEALLY, the aqueous discharge from a mill should be rid of all substances added in its passage through the mill and accessory installations before the water is re-used or discharged into the regional drainage. Complete achievement of the ideal may be impracticable, always, but must be effectively approached as the contiguous territory develops economically and sociologically.

Neutralization of acids or of bases, precipitation of dissolved substances, wet combustions by aeration or bacterial activities are chemical problems of the first importance, generally characterized by the fact that the removal of one contamination involves the introduction of another. A more baffling set of problems is involved in those cases where the contaminations are dispersed in the waste water, not in true solution but in ultimate particles of larger than molecular dimensions. Some are dispersed by Brownian movement and are indubitably colloids; others are temporarily in suspension by virtue of relative surface viscosities, etc. For awhile it was thought that the fact that the particles in such suspensions carried a charge and that they follow the Schülz-Hardy law made simple and easy their removal from wastes. Truly, if in permanent suspension, the particles are charged electrically, and the Schülz-Hardy law is followed qualitatively in that the coagulating power of an ion is greater the greater the valence. Quantitatively the effect of an ion seems to be vastly different between various suspensions; simple or easy control of suspensions has proved disappointingly illusory in practice. We are not sure that surface viscosities, or even that

* Professor of Chemistry, University of North Carolina, Chapel Hill, N. C., and Director of Textile Foundation research on Fundamental Properties of Textile Wastes.

hitherto unrecognized properties, are involved. Evidently, a more comprehensive as well as a more precise knowledge of suspensions is requisite for the development of a sound practice by the sanitary engineer, chemist and bacteriologist. Recognizing the importance of attaining this knowledge as soon as practicable, the Textile Foundation has made possible in the University of North Carolina a study of the fundamental properties of suspensions and control of them. The writer is responsible for the direction and supervision of the investigations. It is considered desirable that, as actual accomplishment is realized, it shall be reported by the individual to whom it should be credited. Thus, the industry and other workers for it will be informed of our progress, and criticism and suggestion will come to us, undoubtedly to the betterment of the study.

Separation of two phases involves precipitation, or its opposite, flotation. Volatilization is of academic interest only in this connection. At the present state of our knowledge suspension is primarily determined by the electrical charge associated with the surfaces and the dispersing medium. The effect of an added electrolyte or a second suspension on the distribution of the charge is of equal concern. A study of these problems constitutes our first line of attack. Details can be postponed advantageously to the descriptions of specific cases which are to follow in later contributions.

Gas bubbles, particularly air and oxygen, have received much attention from the sanitary engineer for the oxidation of suspended organic matter. But minor attention has been given them as a suspension with charged surfaces which charge may aggregate to the importance of that on solid suspensions, if the bubbles be small. Moreover, it appears that control of the charge is easily affected by the addition of electrolytes. It seems desirable therefore to study these effects as the second line of attack.

The enormous practical success of flotation processes in the mining and some other industries makes imperative consideration of the possibility of adapting the principles of these processes to clarification of mill wastes. Our "haziness" as to what constitutes these principles, makes the adaptation difficult. This haziness is due to the pressure for practical results dominating

and more or less occluding efforts to study the principles. That some of the components of mill wastes can be floated, we know; and that the process offers promise of great usefulness, is apparent. A study of the fundamental properties of floated particles has been inaugurated as a third line of attack.

Other approaches to the general problem of the rectification of waste waters are possible, but it appears wise to concentrate upon the three lines of attack cited. Three contributions will be concerned mainly with summaries of the literature, and will be followed by descriptions of the results of current laboratory work.

II. Electrophoresis

By DR. JAMES E. MAGOFFIN *

ONE of the most important fundamental properties of substances in suspension is the electrical charge carried by the individual particles. The repelling force of like charges is extremely important in preventing the particles of a given suspension from coalescing and settling. The sign and magnitude of the charge carried by the particles also determine to a large extent the effect of electrolytes and precipitants on the stability of the suspension. Any substance that reduces or eliminates the charge may cause precipitation, and any substance that increases the charge may enhance the stability of the suspension.

Because of the electrical charge, the particles will move through the suspension in response to an electrical stress. This phenomenon is known as electrophoresis, and was first sytematically studied by Picton and Linder.[26, 27] The speed of electrophoresis is determined by the magnitude of the charge on the particles, the external potential drop, and the viscosity and dielectric constant of the medium. This relationship offers an experimental method of determining the sign and magnitude of the electrical charge carried by particles in suspension.

Methods in use for the experimental determination of electrophoretic velocity may be divided into two main classes: macroscopic and microscopic. In the first are found the moving boundary method developed by Burton[5] and a modification of the Hittorf transference method. In Burton's method, the suspension to be investigated is placed in a U-tube and covered with a liquid of the same conductivity. The electrodes are immersed in this second liquid to prevent polarization effects in the solution proper. The migration velocity is measured by observing the movements of the boundaries under the influence of a known external potential. The main advantages of this method are the easy control of temperature and the avoidance of electroendosmotic effects. Its disadvantages are the difficulty

* Dr. Magoffin is a Senior Investigator of the Textile Foundation, working under the direction of Dr. Frank K. Cameron at the University of North Carolina, and in immediate charge of the laboratory research on the Fundamental Properties of Mill Wastes.

of forming satisfactory boundaries and the presence of the second liquid. Results obtained with this type of method are in good agreement with those obtained with the microscopic methods.[34] The modified Hittorf method involves quantitative analyses of the suspension, which always involves difficulties.

In the microscopic group, the differences are mainly in the construction of the cells used to contain the suspension while the measurements are made. Northrop and co-workers [21, 22, 23] have devised a cell which has proved satisfactory. This has been used by Northrop and Kunitz [21, 22] and by Abramson [1] in a modified form. Mattson [17] also has designed a cell which is in wide use.

The above mentioned cells are single tube cells, and allowances must be made for electroendosmotic effects when they are used. The surface of the containing wall next to the liquid acts as the seat of a double layer. Thus when an external potential drop is applied, the liquid moves tangentially with respect to the containing wall. Since the cell must be closed at the ends, an hydrostatic pressure is built up at one end of the cell, causing a return flow of liquid along the axis of the tube. Thus there are two moving layers of liquid, one moving with the particles and one opposed. In between there is a layer of liquid which is stationary. The measurements of migration velocity must be made in this layer,[38] or else corrected for the effect of the moving liquid. Von Smoluchowski [2] has developed an equation with which this correction can be made, or the depth of the stationary layer calculated.

However, if the cell is so designed as to prevent the return flow of liquid along the axis of the tube under observation, the difficulties of focusing and correction of the observed velocity can be avoided. Smith and Lisse [36] have devised such a cell. Instead of a single tube, two parallel tubes are used, the diameters and lengths being in such ratios as to cause all of the return flow of liquid through one tube. Thus, in the second tube there is only one layer of liquid undergoing movement, the layer immediately next to the containing wall of the cell. In the axial region, the movements of the particles will be unaffected by moving liquid. In this tube observations of the true migration velocity of the particles can be made directly without difficulty in focusing and correction.

Electrophoretic studies have been made on so many substances under such widely differing conditions, that it is foolish to attempt to give a complete summary of results in the space here available. Some outstanding points, however, can be discussed.

The charge carried by the particles can arise from one or both of two sources.[11] The structure of the particle itself may give rise to a difference of potential between the particle and the liquid phase, or a double layer of charges, one bound up closely with the particle and the other more or less widely dispersed throughout the surrounding medium, may surround the particle. Although distinct, these two sources are not entirely separable. In the majority of cases both sources will be involved, although one will be more important than the other.

There is considerable evidence to support the theory that for all substances suspended in a liquid by virtue of being charged electrically, there is a critical potential, above which the particles remain in suspension, and below which they settle.[11, 27, 28, 29, 3] Results with univalent cations and negatively charged suspensions indicate that the theory is not too well founded,

although it seems to hold well for multivalent ions. Muhkerjee[19, 20] claims to find no evidence at all supporting the critical potential theory in his work with arsenious sulfide solutions.

Fromageot[7] showed that the magnitude of the charge carried by particles of carbon in suspension in water depended on the pH of the system. The effect of electrolytes on the migration velocity of charged particles has been extensively studied.[8, 9, 10, 12, 13, 14, 15, 16, 18, 20, 31, 32, 33, 37, 39] In general, univalent cations increase the migration velocity of negatively charged solutions instead of decreasing it as would be expected. Multivalent cations decrease the migration velocity, and as a rule their effects are in the same order as their valences.

The cause of the effect of electrolytes on the migration velocity of suspended particles is open to question. The effect of the electrolytes on the viscosity and dielectric constant of the medium is not large enough to account for the change in the velocity observed. Then it must be some effect on the magnitude of the charge carried by the particles. If the charge on the particles is due to a double layer of ions, the effect of the electrolytes might be due to their effects on the density of the double layer. Or the particles may preferentially adsorb one ion of the electrolyte added.[6, 24, 25, 14] However, the effect of added non-electrolytes[10] is not, apparently, explained by adsorption.

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(*Continued from page 188.*)

The Electrophoresis and Flotation Processes

It so happens that practically all these little particles carry electric charges. They behave like tiny magnets with only one pole so that it would seem possible to collect the particles just as one would pick up tacks from a roadway by running a magnet over them. Suppose instead of the tacks being on the roadway they were floating around in a liquid. It might be possible to run the liquid close to a charged wall like a big magnet and the tacks then would move off on one side and crowd to the wall. This process is known as electrophoresis. In order to use such a process successfully it is necessary to know all about the charges of the particles, the possibility of producing a charge in the "wall" and a number of other facts which can only be gained by a very detailed study of the basic characteristics of these particles.

Suppose the tacks assumed above could be approached by globules of oil carrying electric charges of an opposite sign to the suspended particles. Then each time a tack came near a blob of oil the two would run together, and if the quantity of oil was sufficient, the tack would float up to the top with oil around it. Something of this kind could be done using soap instead of oil, because soap is charged in solution. Or suppose again instead of adding enough material to float up the tack it were possible to coat it with a material that would catch bubbles and then drive air through the liquid. The bubbles of air which would not stick to the original tack would stick to the coated tack and carry it up to the surface. This process is flotation. The particles, once they were collected in any one of these ways, could either be allowed to settle or carried off in a layer of froth, or filtered because of their more granular structure.

Helpful Bulletin Available

These are some of the problems being investigated by the Textile Foundation. As a part of its program of research the Textile Foundation recently issued a 120-page bulletin entitled "Textile Waste Treatment and

(*Continued on page 199.*)

The Distribution of Wax in Cocoon Silk

By WERNER BERGMANN *

A Textile Foundation Publication

Summary

The ether soluble fraction of silk, which consists mainly of silk wax, is not evenly distributed in the various strata of the cocoon. In yellow Italian and white Chinese cocoons the wax content decreases steadily from the external to the inside layers. The significance of these observations has been discussed.

Introduction

THE silk fibre of a single cocoon is not a uniform product. All along its length it shows considerable variations in diameter and specific weight. The chemical composition of the silk of different cocoon layers, which corresponds to the various sections of the fibre, also is not uniform. The amount of sericin for instance decreases steadily from the external to the internal layers of the cocoon as shown in Fig. I.[1, 5] This observation has been used in support of the theory that the sericin and fibroin are secreted in different sections of the silk gland. It is believed that the middle part of the gland is richer in sericin than the posterior part. Consequently, the silk which is secreted first and which forms the first layers of the cocoon is richest in sericin.

The distribution of pigment in yellow cocoons is also far from being uniform. The variations in the pigmentation of different strata of a cocoon is to be considered a racial characteristic of the worm. This interesting phenomenon has been intensely investigated by Jucci.[2] The cocoons of the race "Chinese Gold," possess deep yellow external layers. Toward the inside of the cocoon the pigmentation gradually recedes and the final layers are white. In the cocoons of the race "Italian Yellow" the color increases from the pale yellow of the outside layer to the deep yellow middle layers, to fall off again toward the innermost layers (see Fig. 2). According to Jucci[3] the uneven distribution of the pigment is caused by the difference in time at which the migration of the yellow blood pigment into the silk gland has taken place. In the case of the race "Chinese Gold" this transfer has occurred before the spinning has begun. The first silk which is secreted is deep yellow. During the spinning process, however, considerable quantities of silk are still being formed in the gland, for the

* Senior Research Fellow of the Textile Foundation (1937–38) operating in the Sterling Chemistry Laboratory of Yale University under the direction of Prof. Treat B. Johnson.

coloration of which there is now little if any pigment left. Consequently, the intensity of pigmentation decreases with the progress of the construction of the cocoon. In the race "Italian Yellow" the transfer of pigments takes place at the time the worm has just started to spin. Consequently,

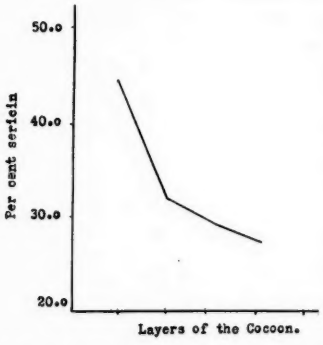

FIG. 1. Distribution of Sericin in Cocoons.

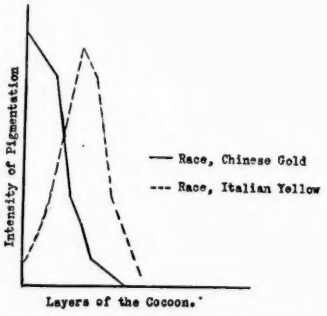

FIG. 2. Distribution of Pigment in Yellow Cocoons (Jucci).

the first silk which is secreted possesses little if any color. The intensity of pigmentation then increases steadily until the supply of coloring matter has been exhausted and the silk becomes paler in color again. This interesting theory has recently been challenged by Buonocore and Malucelli,[4] who hold that the difference in the pigmentation of a cocoon is not a function of the time at which the transfer of the pigment has taken place, but of the section of the silk gland into which this transfer has taken place.

The Distribution of Silk Wax in the Cocoon

Because of the observations which have been described in the preceding paragraph, it has seemed of great interest to the author of the present communication to ascertain whether the distribution of silk wax in the different strata of a cocoon also reveals noticeable variations. In as much as resistance against chemical action and water repellancy are some of the characteristic properties of the wax, the degree of its distribution along the length of a cocoon fibre ought to exert a profound influence on the wetting properties of the latter.

For the investigation of the distribution of the wax, a number of yellow Italian cocoons were opened and chrysalis and exuvia removed. Cocoons, the inside of which had been soiled by diseased insects, were rejected. The normal cocoons were torn by hand into four layers, a process which can be achieved with ease. Samples of the various layers, weighing about 10 gm. were refluxed with 1000 cc. of 80% ethyl alcohol for 24 hours. This procedure decolorized the silk almost to completion. This treatment was followed by a 24-hour treatment with boiling 95% ethyl alcohol. The

layers were then washed with absolute alcohol, placed in a Soxhlet apparatus and extracted with ether for 48 hours.

The alcoholic extracts were carefully evaporated to dryness in vacuo. The residue was taken up in ether, and the solution filtered from insoluble material. All ether extracts were combined and concentrated to about 50

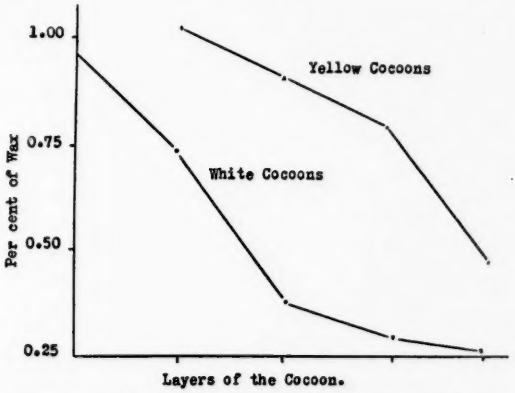

FIG. 3. Distribution of Wax in White and Yellow Cocoons.

cc. The concentrate was transferred to a smaller flask, evaporated to dryness and the amount of residue determined after drying at 105° to constant weight. The results of the determinations are shown in Column 1

TABLE I

The Distribution of Wax in White and Yellow Cocoons

	Yellow	White
Loose silk	—	0.94%
External layer	1.02%	0.72%
Middle layer 1	0.89%	0.37%
Middle layer 2	0.79%	0.29%
Inside layer	0.45%	0.26%

of Table I. The data clearly demonstrate that the amount of ether soluble material decreases steadily from the external to the internal layers.

Yellow silk is not to be recommended for a comparative study of the wax content. The yellow pigment which accompanies the wax in the ether extract is easily oxidized to products difficultly soluble in ether. Varying amounts of such oxidation products, therefore, might noticeably affect the accuracy of the determination of the silk wax. The analyses were therefore repeated with white Chinese cocoons which were still surrounded by loose silk. Special care was taken to carry out all determinations under

identical conditions. The results, which are shown in Column 2 of Table I show that the decline in ether extractable materials from the external to the internal layers is even more pronounced than in the case of the yellow silk. The decrease amounts to approximately 75%.

Discussion of the Results

The data presented in the preceding paragraph prove conclusively that the silk wax is unevenly distributed along an individual silk fibre. Like sericin it decreases from the beginning to the end of the fibre. It is significant that the highest concentration of wax is found in the outside layers of the cocoon. It is here where the protective action of the wax against excessive humidity and desiccation is most desired.

Because of the unequal distribution of the wax the wetting properties along the length of an individual silk fibre must be different; but like the differences in the distribution of sericin and pigment, the variations of the wax content are not very noticeable in the commercial raw silk fibre. In order to obtain a maximum of evenness and uniformity in physical as well as chemical properties, the fibres of the cocoons of different stages of unwinding have been combined to form one raw silk thread. Such a thread represents the average physical and chemical composition of the individual fibre. Whether this process of reeling is sufficient to neutralize the discrepancies in the distribution of wax, is a question which at present cannot be answered. It appears to the author, however, that the possibility of an uneven distribution of the water-repellant silk wax should receive adequate attention in the study of some of the puzzling problems connected with the wetting properties of raw silk.

There are a number of questions arriving from the study of the silk wax for which at present a satisfactory answer has yet to be found. It would be of interest to know, for instance, whether the wax covers the silk in the form of a thin film, or whether it penetrates deeper into the fibre. If the wax should be present merely in the form of a thin surface layer, one might expect to be able to remove it by a simple extraction with ether. Such a process, even when continued over a long period of time, however, leads only to the isolation of a fraction of the wax. Treatment with 80% alcohol followed by extraction with ether, on the other hand, brings about practically complete removal of the wax. This observation seems to indicate that the wax penetrates deeper into the fibre, and that a certain swelling process is necessary to loosen the wax from its surroundings. In this respect the wax behaves very much like the yellow pigment. This substance, too, can be only partially removed by ether extraction, although pigments of that type are very soluble in ether. It is necessary first to break some loose connection between the pigment and the fibre before the latter can be completely removed. A treatment with boiling 80% alcohol is sufficient to effect such a separation.

Another question concerns the ways and means by which the wax has been added to the silk. It would be of interest to know whether the wax is already present in the silk gland at the time the worm begins to spin, or whether it is deposited on the silk during the spinning process. In as much as the wax is of lipoid nature as the coloring matter of yellow silk, the author holds to the opinion that, like the pigment, the wax is transferred

from the blood stream to the silk gland some time preceding the commencement of the spinning process.

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(*Continued from page 186.*)

THE Council of The Textile Institute, Manchester, Eng., has been giving active consideration to "the present unsatisfactory position in regard to the availability of up-to-date text books in textile technology." It has agreed that the Institute should undertake the task of preparing suitable pamphlets or monographs at prices well within the reach of students, and that the work should be entrusted to an Editorial Board. It expects to make a further announcement in this matter in the near future.

(*Continued from page 194.*)

Recovery." The first part of the report is written in non-technical language and is directed to the purpose of giving the mill owner an understanding of the stream pollution problem and general information regarding the nature of his wastes and treatments that may be required. The second part of the booklet contains more technical information and a bibliography that will be of value to his engineer, or other person responsible for the application of corrective processes. It is suggested that this publication will be of great benefit to textile manufacturers who must soon face the problem of relieving the pollution of streams. It may be secured from Edward T. Pickard, Secretary, The Textile Foundation, Commerce Building, Washington, D. C. The price of the book is $1.00 but will be sent free to those qualified to receive it.

Abstracts

Committee on Abstracts and Bibliography:
E. R. Schwarz, Chm., M. W. Weiss, Dr. E. J. Saxl, C. H. Clark.

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Address, C. H. Clark, Sec., 65 Franklin St., Boston, Mass.

I. Fibres (Synthetic and Natural) and Fibre Analysis

Adsorption of Alcohols by Wool. A: Studies on the System: Ethyl Alcohol-Wool. Frank J. Rizzo and Hugh Christison. *Am. Dye. Rptr.*, Jan. 10, 1938, P. 2–6.

This is a contribution from the laboratory of Arlington Mills, Lawrence, Mass. Results of the studies are summarized as follows: (1) Ethyl alcohol is adsorbed by wool to the extent of 1.8% at the drying temperature, if applied to oven-dried material. (2) If applied to wool of normal regain, the alcohol replaces adsorbed moisture and is itself adsorbed. (3) Wool carrying adsorbed alcohol and exposed to the atmosphere loses the alcohol, due to the effect of the moisture in hydrolyzing the ester formed by the adsorbed alcohol with the carboxyl groups liberated by breaking the co-ordinate linkage. (4) Mixtures of methyl and ethyl alcohols show an increased adsorption, over that with ethyl alcohol alone, when concentrations of methyl alcohol are low and then a decreasing adsorption as the methyl alcohol concentration rises. (5) It is found that alcohols greater in molecular size than isopropyl are not adsorbed at the temperature of the conditioning oven. (6) Methyl alcohol is adsorbed by wool to the extent of 1.2% when applied to oven-dried material. (7) Non-hydroxylic compounds, in fact all non-polar compounds, and those incapable of reverting to such, are not adsorbed by wool. (8) The enol form of acetone has been shown to be adsorbed to a small extent when acetone is applied to wool carrying a

normal regain. (9) This study has shown a definite relationship between the percentage adsorption of methyl and ethyl alcohols and their molecular weights. Assuming a similar relationship for monohydrol, water, calculation shows that wool retains 0.7% moisture in the average conditioning oven. It is suggested that this insures stability of the wool under those conditions. (10) The interesting case of the presence of adsorbed cholesterol in scoured wool is discussed. (C)

ARTIFICIAL WOOL. NEW PROTEIN PROCESS. "Colourist." *Silk J.*, Nov. 20, 1937, P. 24, 26; abs. in *Am. Dye. Rptr.*, Dec. 27, 1937, P. 829–30.

Discussion of British Patent 467,704 of Astbury, Bailey and Chibuall for the production of artificial wool from "globular proteins." The latter as defined by W. T. Astbury in "Fundamentals of Fibre Structure" are the large round molecules in which the polypeptide chains are coiled in some specific configuration. Any vegetable globular protein capable of degeneration and denaturation may be employed, and the strongest filaments are obtained when the denaturation has been as complete as possible. (C)

CELLULOSE: SOLUBILITY IN ALKALIS. T. Lieser. *Liebig's Ann. Chem.*, 1937, No. 528, P. 276–95; abs. in *J. T. I.*, Aug. 1937, P. A460. (C)

EUROPEAN STAPLE FIBRES: NEW AND INTERESTING. P. A. Koch. *Rayon Tex. Mo.*, Dec. 1937, P. 57–9. (C)

HEMP AND FLAX FROM THE SEED TO THE LOOM. George A. Lowry. *Rayon Tex. Mo.*, 1937, Nov., P. 72–4; Dec., P. 82–3. (C)

KERATIN FIBRES. W. Harrison. *Chem. & Ind.*, 1937, P. 731–5; abs. in *C. A.*, 1937, V. 31, Col. 7656.

X-ray spectrograms of wool and hair are much less well-defined than those of org. crystals and even cellulose fibres. Cryst. structure is indicated, however. There is a decided difference in the X-ray spectrogram of unstretched hair and wool (-keratin) as compared to that of stretched hair and wool (-keratin). The cuticle of these fibres, because of its elasticity, interferes with the detn. of a definite relationship between stretched and unstretched wool. The X-ray spectrum of wool or hair is changed when they are stretched 30% or more, and the spectrum becomes similar in some respects to that of silk fibroin. Similarity of spacings in stretched hair and wool and natural silk indicates definite similarity in chem. structure. Stretching of fibroin does not produce any change in its cryst. structure since the X-ray spectrum remains const. The stretching of hair or wool does not effect the d. H. believes this to be due to a change in constituents of the fibres. The fibrillar or cryst. constituents become more dense, therefore less liable to chem. attack, while the interfibrillar or intercryst. constituents become broken and are more exposed to chem. attack. H. describes the phenomenon of "permanent set" of woolen fibres by subjecting them to live steam under tension and that of "super-contraction" of set fibres by treatment with reagents such as boiling dil. $NaHSO_3$, boiling KCN soln., cold Na_2S soln. and boiling concd. Ag_2SO_4 soln. Conclusion: Changes in behavior of keratin fibres are due to side-chain breakages. Side chains contg. disulfide linkages such as are present in cystine, a well-known constituent of keratin fibres, are least resistant to the above reagents. (W)

LANITAL AND SYNTHETIC WOOLS. C. Scholer. *Am. Dye. Rptr.*, Dec. 27, 1937, P. 837, 840–3.

Presented at meeting, New York Section, A. A. T. C. C., Nov. 19, 1937. (C)

PROTECTION OF TEXTILE FIBRES BY THE DESTRUCTION OF BACTERIA. A. Foulon. *Deut. Wollen-Gewerbe*, 1937, V. 69, P. 683–4 (through *C. A.*, 1937, V. 31, Col. 5587); abs. in *J. T. I.*, Nov. 1937, P. A640.

There is no great difference in the resistance of cotton and linen goods to bacterial attack although cotton fabrics have a greater tendency to mould formation. Weft yarns are more easily affected than are warp yarns. Black mould (*Tilletia auranticum*) is the most common variety of mould, grows rapidly and can be removed easily. Red moulds occur less often, have a shorter life period and disappear by themselves. Mildew forms frequently because of the extensive distribution of its spores in air and water. The destructive action of these micro-organisms can be overcome by means of "Raschit" "(R)" (6-chloro-3 hydroxy-1-methylbenzene). The compound is water-soluble and practically neutral. "R" also prevents the decomposition of oils and emulsions used for textile treatments and is applied for such purposes by addition of a solution of 1 kg. "R" in 3 litres alcohol to 500 kg. of the oil or else by direct addition to the oil which had been heated to 70°. The use of "R" in the much more easily decomposed emulsions employed in the textile industry has the advantage of stabilizing these sizes for several weeks. Various operations are reviewed. (C)

RAYON: INCREASING THE STRENGTH OF—BY STRETCHING. Bruno Roberts. *Rayon Tex. Mo.*, Dec. 1937, P. 63–5.

A short review of the principles underlying the different methods of the stretching of rayon. Some of these methods are briefly outlined. The properties, advantages and disadvantages, of the stretched filaments are dealt with. (C)

REGENERATED SILK: X-RAY STRUCTURE. I. Sakurada and Y. Matsushita. *J. Soc. Chem. Ind., Japan*, 1937, V. 40, P. 59B; abs. in *J. T. I.*, Nov. 1937, P. A638.

A table records the X-ray interferences for degummed silk and silks regenerated from solution in cuprammonium, "copper-alkali," and mixtures of Zn and Ca chlorides. The regenerated silks give the same diagram as native silk, even to the new X_1 and X_2 interferences. This is in contrast with the differences observed between native and regenerated celluloses. (C)

RHODIA STAPLE FIBRE: PROPERTIES. P. Braun. *Textilberichte*, 1937, V. 18, P. 572–3; abs. in *J. T. I.*, Nov. 1937, P. A639.

A general account is given of the properties and uses of Rhodia staple fibre. This is a cellulose acetate product of 3.7 denier and is particularly useful for mixing with wool. It is delustered in spinning and is crimped. It can be obtained in several colors. Samples of white and green fibre are given. Mention is also made of Lanalbene, a yarn with wool-like properties and high strength and extensibility. (C)

RUSTLING OF RAYON. E. Elod. *Klepzig's Textil-Z.*, V. 40, No. 33, P. 5–6; *Deut. Wollen-Gewerbe*, V. 69, P. 870; *Monatsh. Seide Kunst.*, V. 42, P. 299; *Monatschr. Textil-Ind.*, V. 52, P. 216–7; *Spinner u. Weber*, V. 55, No. 35, P. 20–1 (1937); abs. in *C. A.*, 1937, V. 31, Col. 7658.

One of several causes of rustling is the extremely slight elastic (reversible) stretch of artificial fibres. Dried viscose rayon does not rustle as much as viscose rayon of normal moisture contents. Natural silk acts similarly. If the micellar structure is changed, as by orienting the micelles along the longitudinal axis by stretching the rayon in the swollen state, then the rustling power is diminished. Charging of the artificial textile fibres with artificial resinous products or their condensates was found to decrease the tendency to rustling, presumably on account of a decrease in swelling possibilities thus lowering the capacity for absorbing moisture. In addn. to the decrease in swelling there is also a decrease in the breaking stretch and dye absorption. This decrease in dye absorption can be explained by the hydrophobic character and is due to the deposition of artificial resin particles in the micellar interspaces of the textile fibres. The change in the structure of the fibre by means of artificial resin solns. can be followed easily by treatment with Höhnel's reagent (glycerol, H_2SO_4 and KI soln.). The particle size of the first condensate was found to be of greatest importance. With increasing particle size the rustling power is influenced to a slight extent by such treatment. The uniform distribution of the artificial resin and a low particle size improves greatly the rustling power. It was found furthermore that phenol formaldehyde resin condensates are not as effective for this purpose as are urea-formaldehyde resin condensates under the same conditions. (W)

STAPLE FIBRE: SOLUBILITY IN ALKALIS. H. Christoph. *Kunstseide*, 1937, V. 19, P. 295–8; abs. in *J. T. I.*, Nov. 1937, P. A638.

The mercerization of cotton-staple fibre mixtures is briefly discussed and work on the solubility of rayon and staple fibre in alkali hydroxide solutions is reviewed. The results of determinations of the solubility curves at 20° C of six typical German viscose staple fibre products are discussed. The curves gave a swelling and solubility maximum at 9% NaOH (about 13° Bé). The amount dissolved at this maximum varied from 5 to 45%. The nature of the dissolved portion, and the effects of time of ageing of the alkali-cellulose and of stretching during spinning on solubility are discussed. The effects of stretch-spinning on moisture absorption are also briefly discussed. (C)

VISCOSITY OF SPINNING SOLUTIONS AS A FACTOR OF SPINNABILITY. Bruno Roberts. *Rayon Tex. Mo.*, 1938, Jan., P. 49–51; Feb., P. 71–2.

It has been attempted to point out which are the prerequisites of spinnability and their relation to the spinning process. Especially concentration, homogeneity, surface tension, and elasticity are of similar importance as the viscosity of the spinning solutions. One of the principal mistakes in common viscometry of spinning solutions has been shown. The reasons for unsatisfactory spinnability and methods of its improvement have been outlined briefly. (C)

WOOL AND CASEIN FIBRE: TEST TO DISTINGUISH BETWEEN. C. M. Whittaker. *J. Soc. Dyers Col.*, Dec. 1937, P. 468.

If wool and casein fibre, *e.g.*, Lanital, are immersed for 1 min. in a cold solution of 0.5 g. of certain wool dyes and 0.5 cc. of 80% sulphuric acid per 100 cc. of water, and the material then rinsed, it will be found that the casein fibre is dyed a full shade while the wool is only slightly stained. (Samples were submitted to illustrate this test, the dyes used being Xylene Light Yellow 2G, Azo Geranine 2GS, and Erio Fast Cyanine S conc. respectively.) If a dyed fabric of wool and casein fibre is stained in this manner with a wool dye of contrasting shade to the shade of the dyed fabric under examination, the relative distribution of the two fibres in the fabric can be seen either with the naked eye or under a microscope. This test is equally effective with chlorinated wool. With Neocarmin W, undyed casein fibre is stained a deep orange shade in comparison with the bright yellow produced on undyed wool. Moreover, undyed chlorinated wool, although giving with Neocarmin W a slightly fuller stain of bright yellow than unchlorinated wool, may be readily distinguished from the deep orange stain produced on undyed casein fibre in this way. Under the ultraviolet lamp undyed wool shows a weak violet fluorescence, whereas undyed casein fibre gives a dead white fluorescence. (C)

II. YARNS AND FABRICS

ARTIFICIAL CHAMOIS ON A BASIS OF WOOL FABRIC. S. M. Bresler and I. V. Plotnikov. *Kozhevenno-Obuvnaya Prom. S. S. S. R.*, 1936, V. 15, No. 9, P. 50–52 (through *C. A.*, 1937, V. 31, Col. 5060); abs. in *J. T. I.*, Sept. 1937, P. A500. (C)

CELLULOSE ACETATE: SOME PROCESSES FOR TREATMENT OF CELLULOSE ACETATE AND (WOOL) FABRICS CONTAINING. J. Rolland. *Ind. textile*, 1935, V. 52, P. 310–11; *Chem. Zentr.*, 1936, V. I, P. 4640–41; abs. in *C. A.*, 1935, V. 29, Col. 1254; 1937, V. 31, Col. 3257, 7659.

Studies are reported of the behavior of acetate rayons during carbonization. Impregnation with H_2SO_4 of 3–4° Bé and drying completely destroyed acetate rayons. Under the same treatment with HCl of 3–4° Bé the acetate rayons remained intact. Impregnation with 8% $AlCl_3$ (sp. gr. 1.06) and drying did not damage wool and acetates. Products, like $MgCl_2$, which yield mineral acids at 100–20° were not tested. $NaHSO_4$ has an action similar to that of H_2SO_4. In the HCl treatment drying was done at 100°; with $AlCl_3$ 110–15° is better. With both methods the evolution of corrosive HCl is a disadvantage. In all processes tested by far the better results were obtained with $AlCl_3$. Tensile strength and elasticity were reduced only 1–3% in $AlCl_3$ processes as against 10–50% in other processes. New products from cellulose acetate are suggested such as lustrous and dull short-fibre rayon (Rhodia or Albène), etc. (W)

COTTON FIBRE: EFFECT OF TWIST ON THE STRENGTH AND LENGTH OF. H. Navkal and N. Ahmad. *J. T. I.*, Nov. 1937, P. T307–T338; *Tex. Mfr.*, Jan. 1938, P. 5, 14.

Five Indian cottons (0.64, 0.69, 0.76, 0.82 and 0.89 ins. in length) capable of spinning from 6s to 34s warp yarn were chosen, and in each

case the fibre strength and the percentage contraction were measured with zero twist and after inserting 25, 50 and 100 turns both in the right-handed and left-handed directions. For strength tests, Barratt's apparatus, with certain modifications, was used, while the contraction was read on a micrometer in the eyepiece of a telescope. The mean humidity for each of these twists was kept nearly constant, to avoid applying large corrections on this account. Among the conclusions reported are the following:

If all the results are combined it is found that the effect of left-handed twist is slightly greater than that of right-handed twist. For 0.89-in. cotton mean fibre-strength is unchanged up to 25 turns after which it increases by a small amount and then remains steady for higher twist. For the other cottons the fibre strength increases with twist from the outset, reaches a maximum value and then falls as the twist is gradually increased. But the rates of change of strength and the points at which the maximum values are reached are different for the different cottons. The maximum increase in strength for these cottons lies between 3 and 9% of the value at zero twist.

At 100 turns per cm. (254 turns per inch), there is a considerable fall in fibre strength, which is greater for the shorter than for the longer cottons. At this high twist, the shortest cotton (0.64 in.), lost as much as 24% of its fibre strength, while the longest (0.89 in.) lost practically nothing. Direction of twisting has no effect on the variability of fibre strength. Variation in fibre strength is very nearly constant up to 50 turns per cm., but at 100 turns per cm., it is significantly higher for all cottons except the 0.89 in. Furthermore this increase in strength variability at 100 turns is greater for the shorter than for the medium cottons. Thus, at high twists the fibres of these cottons are not only rendered weaker but also more variable in strength, and in both the cases the effects are greater with the shorter cottons. Direction of twist does not make any difference to the mean value of percentage contraction up to 50 turns per cm. At 100 turns, however, there is a tendency for the fibres to contract more with the right-handed than with the left-handed twist.

The correlation coefficient between the strength and the percentage contraction of fibre is practically zero. Hence it is inferred that in many cases the fibre does not break at its thinnest point, which may in fact be rendered stronger, up to a limit, by the insertion of twist, but at a point where mechanical or bacterial injury has taken place. Variability in the properties of the cotton fibre with twist is discussed, and it is shown that so long as the twist is within the limits usually employed in spinning yarn, it improves, on the whole, the properties of the individual fibres. However, this improvement in fibre-properties in general and in fibre strength in particular can account for only a very small fraction of the increase in yarn strength observed for the same range of twist. The bearing of these results on the molecular chain theory of the structure of cotton fibre is discussed, and it is found that this theory is capable of explaining, in a general way, the principal effects of twist on hair strength observed by us. (C)

COTTON YARNS: STRENGTH AND "SUBSTANCE EFFICIENCY." O. Schmidhäuser. *Textilberichte,* 1937, V. 18, P. 567–71; abs. in *J. T. I.*, Nov. 1937, P. A641.

The influence of the various fibre properties on the characteristics of yarns is discussed and a study is made of the "substance efficiency" of

cotton yarns. This quantity is defined as the ratio of the actual yarn strength to the theoretical strength obtained by multiplying the fibre strength by the number of fibres in the yarn cross-section. The values for cotton yarns range from 35 to 50%. Tables showing fibre properties and yarn counts, twists, strengths and substance efficiencies for American, Egyptian and other types of cotton are given. The influence of fibre fineness, yarn twist, and injury of fibres during processing are discussed, and curves are given showing the variations in yarn strengths and substance efficiencies with twist. (C)

Drawing and Spinning: A Method of Preventing "Static" in. E. Meister. *Klepzig's Textil-Z.*, 1937, V. 38, P. 1; English summary, *Tex. Mfr.*, Dec. 1937, P. 495, 498; *Mell. Textilber.*, 1938, No. 1, P. 21.

Static charging of fibres arises from the actual drafting and may be avoided at high humidity of the air or at lower relative humidities by the method of ionization of the air at the drafting places. (C)

Fireproofing Rayon Fabrics. H. Roche. *Am. Dye. Rptr.*, Dec. 27, 1937, P. 827–29; reprinted from *Silk J.*, Nov. 20, 1937, P. 14, 16.

Rayons used extensively in decorative fabrics are inflammable, and in this article it will be seen that the aim of fireproofing is to cause the material to resist burning and to prevent the access of oxygen by the evolution of gases which inhibit combustion. Fireproofing may tender rayon or affect the handle or color. Many fireproof finishes are not fast to washing. A permanent finish is obtained by using sodium tungstate and tin chloride. A recent method suggests using cellulose esters. Non-inflammable rayon yarns can be produced by incorporating various metallic compounds in cellulose acetate and spinning as usual. (C)

"Fibro" and "Fibro"-Wool Yarns: Development of. W. Hardacre. *J. T. I.*, Oct. 1937, P. P364–P367.

Abstract of lecture given by Mr. W. Hardacre (Courtaulds, Ltd.) to the Midlands Section of the Textile Institute at Leicester Jan. 21, 1937. (C)

High Drafting of Staple Fibre. E. Schmitt. *Mell. Textilber.*, 1937, No. 12, P. 947.

The draft of staple fibre on a ring frame high drafting system can always be kept higher than in the case of cotton, chiefly because the staple is much more uniform. The experience of the author goes to show that a draft of 20 can be used by simply setting on the bobbins with leather apron high drafting systems when the roving is uniform. In the case of staple fibre, particular care must be taken to ensure constant atmospheric humidity and temperature in the spinning shed, because it reacts very strongly to fluctuations in these factors. The tension on the yarn must be kept as low as possible on the fly-frame. (C)

Impregnation of Textile Fabrics. Rud. Taubitz. *Wollen- & Leinin-Ind.*, 1937, V. 57, P. 74–5, 107–8, 142–4, 157–8, 174; abs. in *C. A.*, 1937, V. 31, Col. 7654.

A review of various methods of impregnating textiles to render them resistant to moisture, fire and bacterial action, impregnation with fats in

volatile solvents, application of melted waxes, rendering textiles impervious to water by means of ammoniacal Cu oxide, impregnations which are impervious to air, single-bath impregnations, impregnation formulas, mech. treatments and tests for imperviousness to moisture. (W)

LONG-DRAFT ROVING. A. K. Landau. *Tex. Wld.*, Dec. 1937, P. 84–5.

The author explains why it is possible and profitable in present-day cotton-mill operation. (C)

MERCERIZED THREAD: INFLUENCE OF TWIST, FOLDING NUMBER, ETC. ON PROPERTIES. F. Kurtz. *Textilberichte*, 1937, V. 18, P. 352–56; abs. in *J. T. I.*, Aug. 1937, P. A438.

A systematic study is reported of the effects of structure on the properties of mercerized threads. (C)

MERCHANDISING REQUIREMENTS OF PRINTED TEXTILES. S. J. Kennedy. *Tex. Bull.*, Dec. 30, 1937, P. 4–8.

Paper presented at the Annual Meeting, New York, Dec. 6–10, of the American Society of Mechanical Engineers. (C)

MOISTURE CONTENT TESTS FROM SLASHERS. M. R. Harden. *Cotton*, Dec. 1937, P. 67–8.

The author proves that complete temperature control on slashers is necessary to prevent over-drying of sized warps, and to ensure efficient weaving. (C)

MOTHPROOFING COMPOUNDS. C. N. Sprankle and Ruth Slabaugh. *Tex. Wld.*, Sept. 1937, P. 125.

Gives results of an investigation of a group of fabrics treated with various types of mothproofing compounds and subjected to certain conditions met with in consumer use. (C)

III. CHEMICAL AND OTHER PROCESSING (NOT OTHERWISE CLASSIFIED)

SYNTHETIC ALIPHATIC PENETRANTS. B. G. Wilkes and J. N. Wickert. *Am. Dye. Rptr.*, Dec. 13, 1937, P. 793–99 (reprinted from *Ind. & Eng. Chem.*); *Rayon Tex. Mo.*, Feb. 1938, P. 84–8.

Presented before the Division of Industrial and Engineering Chemistry, 94th meeting, American Chemical Society, Rochester, N. Y., Sept. 6–10, 1937. The chemical structures of sodium secondary-alcohol sulfates and a number of other compounds possessing surface activity are described. A comparison is made of their relative wetting action, surface tension, and lime soap dispersibility under neutral, acid, and alkaline conditions. In addition, some commercial applications in which these sodium secondary-alcohol sulfates are or can be used to advantage are briefly described. (C)

SYNTHETIC RESINS IN TEXTILE TREATMENT: NEW USES, EXCEPTING ANTICREASE, FOR. A. J. Hall. *Silk J.*, 1937, V. 14, No. 159, P. 30–1; No. 163, P. 33; abs. in *C. A.*, 1937, V. 31, Col. 7655.

The resins give embossed finishes resistant to washing. They increase the attraction and fixation of acid dyes to cotton. Since formaldehyde-urea

resins are best formed under acid conditions, the use of hexamethylenetetramine in hindering their rapid formation provides softer fabrics and also better acid-dye attraction. Similarly, softer fabrics are to be obtained if substances liberating acid are used with the resins, instead of direct acid, under heating, by avoiding premature formation of the resins. (W)

SYNTHETIC WASHING AGENTS IN THE TEXTILE INDUSTRY. G. S. Ranshaw. *Chem. Age* (London), 1937, V. 37, P. 133–4; abs. in *C. A.*, 1937, V. 31, Col. 7257. (W)

TEXTILE FINISHING: QUANTITATIVE CONTROLS IN. R. E. Rupp. *Cotton*, 1938, Jan., P. 45–7; Feb., P. 102–4.

Following an informative discussion of the relative accuracy of qualitative and quantitative comparisons of finishing materials and solutions, and after admitting that it is possible for a careful and skilled operator by careful checking and untiring vigilance to control a solution with sufficient accuracy, the author describes the construction, use and basic principles of two automatic mechanical controls for specific gravity of solutions of high concentration, and another simple electrical device for the control of the concentration of dilute solutions based upon maintenance of relatively constant electrical conductivity. He notes the limitations of the latter type of control, and in a future article will describe controls based upon electric potentiometer measurements. (C)

TEXTILE ASSISTANTS. II. THEIR CHEMISTRY AND USE. F. G. Brown. *Tex. Col.*, Dec. 1937, P. 821–23, 843; Jan. 1938, P. 13–15, 60. (C)

(THIS) WATERPROOFING BUSINESS. "Textile Chemist." *Silk J.*, 1937, Nov. 20, P. 27–8; Dec. 20, P. 30, 33; 1938, Jan. 20, P. 42, 45; Feb. 20, P. 38, 40.

In this and succeeding articles a brief review will be given of all methods of producing water-repellency, with references to patents which seem to indicate the trend of progress in each section. The subject is discussed under the following headings: (1) Emulsions of wax, fatty acid and metallic soaps. (2) Metallic salts of high-molecular compounds. (3) Rubber. (4) Crease-resistance and water-repellency. (5) Chemical compounds with the fibre. (6) Polymerized compounds. (7) Miscellaneous methods. (C)

UNSHRINKABLE WOOL: METHODS, CHEMICALS AND EQUIPMENT EMPLOYED IN SULPHURYL CHLORIDE PROCESS FOR PRODUCING. *Tex. Wld.*, Dec. 1937, P. 76–7. (C)

VAT COLORS ON RAYON VISCOSE: NOTES ON APPLICATION OF. Raffaele Sansone. *Tex. Col.*, Jan. 1938, P. 16–19. (C)

VAT DYES: IDENTIFICATION OF. Eduard Herzog. *Deut. Färber-Ztg.*, 1935, V. 71, P. 472; *Chem. Zentr.*, 1936, I, P. 4077; abs. in *C. A.*, 1937, V. 31, Col. 7253.

Reports on and completes the classification or grouping of dyes on the basis of their behavior toward $SnCl_2$ (cf. Korolev and Rostovzeva, *Deut. Färber-Ztg.*, 1935, 71, 315–16). A criticism of reaction tables of vat dyes and indigo is answered. (W)

WASHING OF TEXTILES AND THE CONSTITUTION OF MODERN DETERGENTS: MODERN VIEWS UPON. Part 2. A. Chwala and A. Martina. *Mell. Textilber.*, 1937, No. 12, P. 998.

The present study refers to the theoretical information of Part 1 in regard to the fine structure of aqueous dispersions of the anion and cation soaps (*Mell. Textilber.*, No. 9, 1937). It is shown that a detergent theory in order to be complete must evaluate the process of washing from the point of view of detergent, the extent to which the goods have been soiled, and the textile material itself. An opinion upon washing and the washing effect can only be arrived at on the basis of the sum of three factors. Modern synthetic detergents of non-ionogenic nature are briefly discussed together with their structure and effect in aqueous dispersion. The article shows how the washing effect depends upon the nature of the dirt present by means of the example of wool that has been treated with mineral oil and with olive oil from which the grease has been removed to a varying extent by scouring. The effect of the nature of the dirt on the conditions of binding and adsorption is explained by the results of wetting tests of anion-active soaplike colloid electrolytes on non-ionogenic detergents in the case of woollen and cotton fabrics.

WATERPROOFING TEXTILES: NEW DEVELOPMENT IN. C. H. S. Tupholme. *Tex. Col.*, Jan. 1938, P. 52–3.

Describes the water-repellent Velan, a British product which can be used on both vegetable and animal fibres. (C)

WETTING AGENTS: NEW SERIES OF ALIPHATIC SULFO-DICARBOXYLIC ACID. H. W. Rose. *Am. Dye. Rptr.*, Dec. 27, 1937, P. 825–27. (C)

WHITENESS: DEGREE OF—OBTAINABLE BY BLEACHING. ITS RELATION TO VARIETIES OF COTTONS. G. B. Jambuserwala. *Am. Dye. Rptr.*, Dec. 13, 1937, P. 799–802, 820. (C)

WOOL: SAFEST TREATMENT OF. E. Elöd. *Monatsh. Seide Kunst.*, V. 42, P. 296; *Deut. Wollen-Gewerbe*, V. 69, P. 864; *Spinner u. Weber*, V. 55, No. 31, P. 9–10 (1937); abs. in *C. A.*, 1937, V. 31, Col. 7656.

Damages in wool can best be recognized by studies of the velocity of the absorption of dyes. Woolens of different origin differ in velocity of dye absorption owing to variations in macroscopic structure. Woolens of the same origin act alike with regard to amt. of dye absorbed. The valuable properties of wool are best preserved during washing, dyeing and carbonizing by careful control of pH, time and temp. The velocity of diffusion increases with the coarseness of the wool. All treatments of wool should be carried out as closely as possible to the isoelec. point (pH 4.7). (W)

WOOL: UNION OF CHROMATED DYES TO. W. Ender. *Klepzig's Textil-Z.*, V. 40, No. 32, P. 3; *Monatsh. Seide Kunst.*, V. 42, P. 298; *Deut. Wollen-Gewerbe*, V. 69, P. 869–70; *Monatschr. Textil-Ind.*, V. 52, P. 215–16; *Spinner u. Weber*, V. 55, No. 35, P. 20 (1937); abs. in *C. A.*, 1937, V. 31, Col. 7652.

Acid wool dyes contg. Cr in complex groupings are superior to non-Cr dyes in fastness to moisture, sweat, light and the like. The free dye acids

of such dyes are amphoteric compds. contg. a basic, pos. Cr group. Studies were made to det. whether the Cr group of the chromated dye acid takes part in the union of wool to dye acid. The amt. of dye which was absorbed on dyeing with free chromated dye acids was detd. gravimetrically as well as the amt. of residual free basic groups of the wool. It was found that the sulfo groups of the chromated acid dyes form salts with the basic groups while the Cr group which is located opposite to the sulfo group in the dye mol. reacts as a cation with addnl. basic groups of the wool with the formation of complex salts. These basic groups lose thereby their basic character, *i.e.*, their dissocn. power. Only about 10% of the basic groups in wool will undergo such complex reactions with Cr. The remaining groups will absorb the residual chromated dyes like an ordinary acid wool dye and thus the free sulfo groups which are not hampered by inner mol. complex formation with Cr will react with the wool forming salts. The results of these expts. show that above the limiting value of 1/10th of the basic groups the dyes contg. no free sulfo groups are incapable of addnl. salt formation with wool. This is the reason for the low absorption power of chromated monosulfo acids while that of the disulfo acids is approx. equiv. to that of the slowly absorbing, ordinary acid dyes. The addn. of mineral acids increases the velocity of absorption. The lower the pH value the smaller the tendency for complex reactions. In practical dyeing work acids are added which make the dyeing more level by increasing the formation of complex compds. as much as possible. The absence of a sufficient amt. of acid represses the tendency to complex formation and weakens the wool-dye acid compd. as well as the fastness properties of the dyed product. (W)

IV. Research Methods and Apparatus

Analytical Control of Cellulose Acetate Rayon Production. *Silk & Rayon*, 1937, P. 548; abs. in *Rayon Tex. Mo.*, Dec. 1937, P. 100.

The article presents information and data on methods of determining concentration, viscosity, water content and clearness of acetate spinning solution, and the oil and acetone content of the spun filaments. A table giving the specific gravities of mixtures of acetone and water is provided. The determination of water in the viscose solution is depending on the decrease of solubility of nitro-benzene in acetone with increasing water content. (C)

Brightness Meter. M. Luckiesh and F. K. Moss. *J. Opt. Soc. America*, 1937, V. 27, P. 292–3; abs. in *J. T. I.*, Nov. 1937, P. A667.

A simple instrument for measuring relative brightness and brightness contrasts is described. The image of the object is seen in the centre of the photometric field surrounded by a mirrored portion, which is the comparison brightness. The brightness of the object focussed is varied by means of a circular gradient of extensive range in transmission factor. The relative brightness is read off from a scale. The actual range in brightness obtainable by the gradient is of the order of 2,000 to 1, and reducing and multiplying screens can be inserted to extend this range. Conversion of relative into absolute brightness is easily attained by means of foot-candle meters. (C)

CELLULOSE FIBRES: DETECTION BY REFRACTIVE INDEX. A. Frey-Wyssling. *Mikrochemie, Molisch Festschrift*, P. 106–17; abs. in *J. T. I.*, Nov. 1937, P. A639.

Cellulose hydrate has a much lower refractive index than native cellulose and slightly degraded hydro- and oxy-celluloses have slightly higher indices. They can therefore be distinguished by the Becke line method; the fibre, mounted in a liquid medium, shows a bright line which moves to the higher-refractive substance on racking up the microscope tube. The medium can be adjusted until the Becke line disappears and its index measured in a refractometer. Although nitrocellulose and cellulose acetate have lower refractive indices than native cellulose, the test is not so suitable for general distinctions because of possible irregularities in the fibre surface. It reveals unevenness of esterification (or the reverse in saponified material) in a striking manner. (C)

MEASURING THE THERMAL TRANSMISSION OF TEXTILES: IMPROVED APPARATUS FOR. Richard S. Cleveland. *B. S. J. Rsch.*, Dec. 1937, P. 675–84.

A horizontal plate is heated electrically and maintained at a constant temperature by means of a thermostat. The plate is surrounded by a guard plate which is also maintained at the same temperature to prevent lateral flow of heat into or out of the central plate. A second guard heater is placed below the central plate to prevent the downward flow of heat. The specimen to be tested is laid flat without tension on the apparatus and enclosed in a copper hood placed several inches above it to eliminate the disturbing influence of air currents of the room. Since the thermostatic control results in an intermittent supply of heat to the central heater, an electric clock is added to the circuit, thus automatically adding the periods during which heat is being supplied. The difference in temperature from the central plate to the top of the hood is measured by means of a thermocouple and microammeter. The amount of heat supplied to the central heater per unit of time divided by the difference in temperature from the central plate to the hood and by the area of the hot plate is taken as a measure of the thermal transmission of the specimen. The reproducibility of results, the influence of differences in temperature between the central plate and the guard plates, and the influence of the height of the hood are discussed, and values of thermal transmission for typical fabrics are given. The regulation of temperatures is essentially automatic and little attention is required from an operator except during the 15 minutes a test is actually in progress. The hot plates can be operated at any temperature desired. About seven tests can be made in an 8-hour day, allowing proper time for the attainment of a steady state. The results are usually reproducible to about 1%. (C)

MICROSCOPICAL DETECTION OF VISCOSE SILK MIXED WITH COTTON AND OTHER TEXTILE FIBRES. *Boll. Staz. sperim. Ind. Carta Fibre Tess.*, 1937, V. 32, P. 89–90 (through *Brit. Chem. Abs. B.*, 1937, V. 56, P. 768); abs. in *J. T. I.*, Nov. 1937, P. A641.

The fibre, after immersion in 6% caustic soda for one minute is treated with a solution of a direct dye and observed under the microscope. Viscose silk is swollen and evenly dyed with marked longitudinal striations. Cotton, even if mercerized, is almost unattacked. Hemp may be dyed, but always

unevenly. Cuprammonium silk is dyed like viscose, but is less swollen and lacks the striations. Approximate determination of the viscose content of mixed textiles is possible. The method is not applicable to textiles which have received an anti-crease treatment, owing to the impermeability of the resin, but provides a means of controlling this process. (C)

PHOTOELECTRIC INSTRUMENTS FOR THE MEASUREMENT OF COLOR, STUDY OF: REFLECTANCE AND TRANSMITTANCE. PART II. THE GENERAL RADIO COLOR COMPARATOR, TYPE 725-A. PART III. LANGE PHOTOELECTRIC REFLECTION METER. Staff of The Institute of Paper Chemistry. *Paper Trade J.*, Dec. 16, 1937, P. 46–50; Dec. 30, 1937, P. 42–6. (C)

PRODUCING STANDARD ARTIFICIALLY SOILED WOOL FABRIC: METHOD OF. P. W. Cunliffe. *J. T. I.*, Dec. 1937, P. T341–T348.

The removal of soil by a detergent solution is greatly influenced by the mechanical action to which the fabric is subjected in laundry processes. The original object of the present work was in connection with the standard washing test for the determination of the resistance to shrinkage of wool fabrics. It was hoped that the use of a standard soiled fabric would obviate the need for specifying the type, and the conditions of running of the machine, in which the shrinkage test was carried out. This object was not achieved, there being no satisfactory correlation between the removal of soil and the shrinkage produced in different types of commercial machines. It is thought, however, that the description of the new method of producing artificially soiled fabrics, and of the behavior of such fabrics on washing and storage, will be of use to others engaged on problems of detergency. (C)

SCHOPPER DURABILITY BENDING TESTER IN COMPARISON WITH THE PAPER FOLD TESTER: EXPERIMENTS WITH THE NEW. Korn. *Papier-Fabr.*, Jan. 29, 1937, P. 33–7; abs. in *Paper Trade J.*, Dec. 23, 1937, P. 44.

Certain disadvantages of the fold tester are first discussed and then the durability bending tester as an instrument which eliminates these faults. Several different types of paper are then tested with both testers and under different loads, and curves drawn to show the relationship. (C)

SHAWMUT LABORATORY. *Tex. Wld.*, Dec. 1937, P. 117–19.

Testing and control laboratory of West Point (Ga.) Manufacturing Co. and allied mills described and illustrated. (C)

STIFFNESS AND RESILIENCY: QUANTITATIVE MEASUREMENT OF. Irving J. Saxl. *Rayon Tex. Mo.*, 1938, Jan., P. 57–8; Feb., P. 77–8.

Means have been developed by various investigators to evaluate stiffness quantitatively. After considering the factors that influence and are involved in the testing and measuring of stiffness, a new instrument is described. The technique of stiffness measurements, as they relate to load versus deflection characteristics, mechanical hysteresis, elastic recovery, and permanent deformation are discussed. Methods are described for measuring stiffness, elasticity, crush resistance under practical mill and testing laboratory conditions. (C)

TEXTILE FIBRES: THERMAL CONDUCTIVITY. I. G. Farbenindustrie, A.-G. *Textilber.*, 1937, V. 18, P. 684–87; abs. in *J. T. I.*, Dec. 1937, P. A714. (C)

STANDARDIZATION OF TEXTILE TESTING METHODS. *Tex. Mfr.*, Jan. 1938, P. 7–8.

Summary of discussions on the subject at recent meetings of British textile associations, and particularly at those of the Textile Institute, which is actively promoting such standardization. (C)

WOOL: DETERMINATION OF FINENESS OF. O. Bernhard. *Mell. Textilber.*, 1938, No. 1, P. 11.

This article contains a brief description of the Lanameter made by Messrs. O. Reichert, Vienna. Scales showing the fineness of wool in the form of a diagram are given which make it possible to compare the various types of classification and to correlate them with the metrical count of the fibre. (C)

WOOL RESEARCH IN 1937. *Tex. Mfr.*, Jan. 1938, P. 8.

Low-twist rubberized wool yarns, measurement of unshrinkability, woolen slubbing irregularity, wool oils and substitutes are some of the subjects dealt with during the year by the British Wool Industries Research Association. (C)

WOOL SAMPLES: METHODS FOR THE ESTIMATION OF MEDULLATION IN. P. R. McMahon. *J. T. I.*, Dec. 1937, P. T349–T360.

Elphick's visual method for the evaluation of medullation revealed by the "Benzol" test has been shown to possess certain inherent failings, and a more accurate technique developed on a visual basis proved too slow for routine application. A photo-electric apparatus has been constructed which is capable of measuring degrees of medullation rapidly and with considerable accuracy. An approximately linear relation has been found between the index so obtained, and the percentage air-space in the fibre calculated from accurate specific gravity determinations in benzene. The apparatus has proved satisfactory under routine conditions, and has been used on an economic basis by an official fleece testing organization in New Zealand during the past two years. (C)

V. ECONOMICS, PHYSICS AND MISCELLANY

ADSORPTION AND WETABILITY OF SOLID SURFACES. D. H. Bangham and R. I. Razouk. *Trans. Faraday Soc.*, Nov. 1937, P. 1459–63.

The work $W = \gamma_{LV}(1 + \cos\theta)$ which is done per unit area when a solid and a liquid are pulled apart, is to be distinguished from the work of adhesion as commonly understood, and is largely determined by the nature and properties of the adsorbed phase formed from the saturated vapor. Where supersaturation effects can occur in the vapor phase in the presence of the solid surface, the wetting angle θ is finite, and the aggregational state in the absorbed phase must differ in some way from that in the bulk

liquid. The heat of immersional wetting is given by $F_L - T^{d^F}L/dT$(F_L = surface energy lowering on immersion) and is to be distinguished from the total heat of adsorption at saturation. (X)

CELLULOSE, STARCH AND GLYCOGEN. H. Staudinger. *Naturwiss.*, Oct. 15, 1937, P. 673–81.

The difference in behavior of optical rotation, viscosity, polymerization and other general properties. It is deduced that viscosity depends on length of the chain of glucose residues, that these are united by principal valencies, and accordingly that the colloid particles are macromolecules. On these grounds molecular structures are proposed, that for cellulose being linear, the chains containing some 2000 residues, while starch and glycogen consist of a number of comparatively short chains of about 25 and 12–20 residues respectively, united together by a central chain which forms, so to say, a backbone to the molecule, but which is not so long that the molecule is not predominantly spherical. In all three only the end residue of a chain forms on complete methylation tetramethylglucose, the intermediate residues giving rise to the trimethyl derivative, thus explaining the much higher proportion of tetramethylglucose obtained from starch or glycogen. (X)

COLLOIDAL INVESTIGATIONS: EMPLOYMENT OF SUPERSONICS IN. H. A. Wannow. *Kolloid-Z.*, Oct. 1937, P. 105–13.

A short report is given of methods of producing supersonic waves and their use in colloidal investigations. A bibliography of the literature on the subject is given and short comments on the result obtained in each experiment are made. The action of supersonic waves is shown to produce and increase dispersion between different liquids and between a liquid and a solid; to cause the splitting of highly polymeric molecules, to favor peptonization, to cause coagulation in aerosols, and to produce orientation of particles of certain sizes. (X)

COLLOID SOLUTIONS: AN INVESTIGATION ON QUIET AND FLOATING. K. Hess and J. Gundermann. *Ber. der Deuts. Chem. Gesselschaft*, 1937, V. 70, P. 1800.

The author attempts to prove roentgenologically the orientation of colloid particles. This has been proven previously by the coefficient of birefringence. Important data are found by them that permit conclusion as to the size of soap micelles in fluent soap solutions. On the X-ray pictures only the inner ring changes its shape which permits the conclusion that the suspended particles do not have the shape of small rods, but have to be leaves which lie plane-parallel to the direction of the current. The hypothesis is made that the fatty acid chains stand normally upon the individual layers. In view of the importance of the physical and chemical properties of soap and colloidal solutions such as sulphonated oil in water, investigations of this nature should be encouraged also in this country. (X)

DIELECTRIC MEASUREMENTS OF HYDROPHILIC COLLOIDS. PART I. P. J. Denekamp and H. R. Kruyt. *Kolloid-Z.*, Oct. 1937, P. 62–80.

The dielectric constants of agar and gelatin sols have been measured at a wave-length of 261 m., and are higher than that of water. This ele-

vation stands in close connection with hydration and disappears with dehydration. The dielectric constants of agar sol and agar gel are equal at the same temperature, whereas that of gelatin decreases on gelatinisation. The agar micelle posesses no permanent electric moment but the gelatin micelle has an amphoteric character. A chemical change in the transition from sol to gel cannot be traced by means of dielectric constant measurements. The paper is replete with experimental methods and data therefrom. (X)

DRIERS IN THE PAPER INDUSTRY. Ogden Minton. *Paper Trade J.*, Feb. 17, 1938, P. 30–4.

Mainly devoted to a description of the vacuum-type drier, and its advantages as compared with open- and air-type driers. (C)

FUNDAMENTAL RESEARCH: WHAT CAN THE MILL MAN EXPECT FROM—? Milton Harris. *Am. Dye. Rptr.*, Jan. 10, 1938, P. 6–8. (C)

pH VALUES: PHOTO-ELECTRIC MEASUREMENT WITH INDICATOR SOLUTIONS. G. F. Lothian. *Trans. Faraday Soc.*, 1937, V. 33, P. 1239–43; abs. in *J. T. I.*, Dec. 1937, P. A733.

A development of Brode's method for the determination of pH is given, based on the measurement of the absorption of an indicator solution over a finite band of wave lengths transmitted by a filter that transmits light at the wave-lengths covered by the absorption band of the indicator. Results for methyl red are given. The advantages of this method are (1) that it is not necessary to maintain standard solutions for matching, (2) that the method is independent of the visual judgment of color matching, and (3) that a small quantity of indicator only is necessary. In weakly buffered solutions addition of indicator may change the pH value. (C)

PHENOLS AND PLASTICS: RECENT STUDIES OF. Sir Gilbert Morgan and A. E. J. Pettet. *J. Soc. Dyers Col.*, Jan. 1938, P. 17–23.

The production of low temperature tar on an industrial scale rendered desirable a systematic chemical examination of this crude tar oil and accordingly at the end of 1925 an investigation of the then comparatively unknown material was begun at the Chemical Research Laboratory, Teddington, Eng., under the auspices of the Department of Scientific and Industrial Research. The first account of this research was published three years later (*J. S. C. I.*, 1938, *47*, 131T) and this description has been amplified in several subsequent communications (*Ibid.*, 1929, *48*, 29T; 1931, *50*, 191T; 1932, *51*, 67T; 1934, *53*, 71T; 1935, *54*, 19T). This paper reports results of further studies. (C)

PLANE BOUNDARY-PROBLEMS OF THE THEORY OF ELASTICITY. E. Weinel. *Z. für angew. Math. u. Mechanik*, Oct. 1937, P. 276–87.

The object of the paper is to show that plane elastic problems can conveniently be solved in terms of a suitable curvilinear coördinate system, and ring coördinates are chosen as the example. After general results have been obtained, the following problems are solved in detail: (1) Stresses in a tube under pressure with an eccentric bore; (2) stresses in an infinite

plate containing two holes under tension; (3) stresses in a semi-infinite plate with one circular hole. (X)

TEXTILE EDUCATION: VALUE OF—TO THE TEXTILE INDUSTRY. Louis A. Olney. *Canadian Tex. J.*, Feb. 18, 1938, P. 26–7, 44–6, 56; *Am. Dye. Rptr.*, Mar. 7, 1938, P. 117–22.

Address delivered at the annual meeting of the Ontario Section, Canadian Association of Textile Chemists and Colorists, Hamilton, Ont., Feb. 5, 1938. (C)

TEXTILE TECHNOLOGY: THE WHAT OF. E. R. Schwarz. *Am. Dye. Rptr.*, Dec. 13, 1937, P. 805–8.

Presented before meeting, Northern New England Section, A. A. T. C. C., Nov. 5, 1937. (C)

WATER-SOLUBLE CELLULOSE ETHERS. PREPARATION AND THEORY OF SOLUBILITY. L. H. Bock. *Ind. Eng. Chem.*, 1937, V. 29, P. 985–7; abs. in *J. Soc. Dyers Col.*, Dec. 1937, P. 494.

Soluble ethers, containing 0.6–0.7 methyl or ethyl group, are obtained by adding an alkyl halide or sulphate to a solution of cellulose in a quaternary ammonium hydroxide containing unsubstituted hydrocarbon groups, preferably a benzylammonium hydroxide, at ordinary temperature. A possible explanation of why the alkali cellulose method of preparation requires the introduction of more (1.2–1.6) methyl or ethyl groups to obtain water-soluble products, is that a more even distribution of alkyl groups is obtained when cellulose is alkylated in solution. (C)

WOOL FAT: COMPOSITION OF. A. Heiduschka and E. Nier. *J. pr. Chem.*, 1937, V. 149, P. 98–106; abs. in *J. Soc. Dyers Col.*, Nov. 1937, P. 445.

Cerotic acid has been isolated from the fatty acid mixture obtained by saponifying wool fat with alcoholic caustic potash. After purification via the ethyl ester and the lithium salt, it had m.p. 78° C. and was identical with the product isolated from beeswax. Lanoceric acid separated as a grey insoluble residue when the mixture of fatty acids was dissolved in ether, and, after recrystallization from carbon tetrachloride, had m.p. 102.5° C. Ceryl alcohol, isocholesterol and cholesterol were isolated from the unsaponifiable fraction of wool fat by several crystallizations and precipitations from ethyl and methyl alcohols, but, contrary to the results of former investigators, no carnaubyl alcohol could be detected. (C)